

Claims

1. A protein solution for use in protein film formation, **characterized** in having pH 7 or below and containing modified protein, which is modified by cleaving at least one disulfide bond originally present in said protein by sulfitolysis to obtain
5 free sulfhydryl groups, which are able to cause an interchange reaction to form disulfide bonds between the proteins.
2. A protein solution of claim 1, **characterized** in that the amount of free sulfhydryl groups in the total protein of the solution before the interchange reaction is 0.5–60 $\mu\text{mol/g}$ protein.
- 10 3. A protein solution of claim 1 or 2, **characterized** in that said modified protein comprises whey protein.
4. A protein solution of any of the preceding claims, **characterized** in that said protein is sulfonated in said sulfitolysis by contacting it with sulfite ion forming agent.
- 15 5. A protein solution of claim 4, **characterized** in that said sulfite ion forming agent comprises alkali metal or earth alkali metal sulfite, hydrogen sulfite or metabisulfite or combinations thereof.
6. A protein-based film comprising a protein network formed by disulfide bonds between the proteins, **characterized** in comprising a protein network which is
20 formed by treating proteins with modified protein in a solution having pH 7 or below, which protein is modified by cleaving at least one disulfide bond originally present in said protein by sulfitolysis to obtain free sulfhydryl groups, whereupon an interchange reaction by said free sulfhydryl groups has occurred forming said disulfide bonds between the proteins.
- 25 7. A protein-based film of claim 6, **characterized** in that the amount of free sulfhydryl groups in the total protein of the solution before the interchange reaction is 0.5–60 $\mu\text{mol/g}$ protein.
8. A protein-based film of claim 6 or 7, **characterized** in that said modified protein comprises whey protein, such as the soluble fraction from whey protein isolation
30 process.
9. A protein-based film of any of the claims 6–8, **characterized** in that said protein is sulfonated by said sulfitolysis by contacting it with sulfite ion forming agent.

10. A protein-based film of claim 9, **characterized** in that said sulfite ion forming agent comprises alkali metal or earth alkali metal sulfite, hydrogen sulfite or metabisulfite, or combinations thereof.
11. A protein-based film of any of the claims 6–10, **characterized** in that said solution is heated to further promote the interchange reaction and film formation.
12. A protein-based film of any of the claims 6–11, **characterized** in that said film is formed on a substance to coat the substance.
13. A protein-based film of claim 12, **characterized** in that said substance is a food product.
14. A protein-based film of claim 12, **characterized** in that said substance is a tablet, granule, pellet or like, which contains therapeutically active agent.
15. A protein-based film of any of the claims 6–14, **characterized** in that said film is formed as a capsule shell.
16. A protein-based film of any of the claims 6–15, **characterized** in that said film is formed around lipid, oil, lipophilic compound or combinations thereof to form an emulsion or microcapsule.
17. A protein-based film of any of the claims 6–16, **characterized** in that a further plasticizer or lipophilic compound, such as stearate, butter fat as oil or true oil or combinations thereof, is added.
18. A protein-based film of any of the claims 6–17, **characterized** in that a further strength-improving agent, such as carbohydrate, such as maltodextrin or other starch hydrolysate, is added.
19. A protein-based film of any of the claims 6–18, **characterized** in that a further pigment dye, such as titanium oxide, antiadhesive agent, antimicrobial agent or preservative agent is added.
20. A food product, **characterized** in that it is coated with or contains substances coated with a film of any of the claims 6–19.
21. A baby's milk formula, **characterized** in that it contains film of claim 16 as an emulsion.

22. A pharmaceutical product containing at least one therapeutically active agent, **characterized** in that it is coated with a film of any of the claims 6–19.
23. A container, **characterized** in that it is coated with a film of any of the claims 6–19.
- 5 24. Method for preparing a protein-based film comprising a protein network formed by disulfide bonds between the proteins, **characterized** in comprising
- providing an amount of solution of any of the claims 1–5, and
 - forming said solution into said protein-based film.
- 10 25. Method of claim 24, **characterized** in that said modified whey protein comprises the soluble fraction or precipitate fraction of modified whey protein or combinations thereof.
26. Method of claim 24 or 25, **characterized** in comprising heating the protein solution to further promote the interchange.
- 15 27. Method of any of the claims 24–26, **characterized** in comprising forming the film on a substance to coat the substance.
28. Method of any of the claims 24–27, **characterized** in comprising forming the film on a food product.
29. Method of any of the claims 24–28, **characterized** in that said substance is a tablet, granule, pellet or the like, which contains therapeutically active agent.
- 20 30. Method of any of the claims 24–29, **characterized** in comprising forming the film as a capsule shell.
31. Method of any of the claims 24–30, **characterized** in comprising forming the film around lipid, oil, lipophilic compound or combinations thereof to form an emulsion or microcapsule.
- 25 32. Method of any of the claims 24–31, **characterized** in comprising adding a further plasticizer or lipophilic compound, such as stearate, butter fat as oil or true oil or combinations thereof.
- 30 33. Method of any of the claims 24–32, **characterized** in comprising adding a further strength-improving agent, such as carbohydrate, such as maltodextrin or other starch hydrolysate.

34. Method of any of the claims 24–33, **characterized** in comprising adding a further pigment dye, such as titanium oxide, antiadhesive agent, antimicrobial agent or preservative agent.